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Basics of strip enlargers

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Panoramic cameras of the rotating type have a propensity for generating negatives with a very large aspect ratio. When making photographs with 360 degree coverage these sometimes exceed 1:10 in proportion. This means that if the camera is a 35mm model the negative will be about 10 inches long and a 2 1/4 camera would produce a negative that is more than 20 inches in length.

These panoramic "strip" cameras can also be used for other, more unusual, applications such as photofinish (like in racetracks) photographs and also peripheral photographs or simply continuously expose a full roll so that no frame lines are generated at all along the full length of the film. Aspect ratios between height and length of some of these unusual and "experimental" applications can exceed 1:50 or more and in the case of a 35mm camera system the negative could be as long as the full length of a roll of film.

Needless to say, such negatives do not lend themselves to be enlarged due primarily to the fact that there are few (read none) enlargers capable of handling a length of negative as long as these camera can produce. To solve the problem one can print these negatives in sections and this is a solution that si quite practical. However, if one wants a seamless enlargement the solution lies in an enlarger capable printing using essentially the same system as was used for the making of the original negative.

The theory behind such an enlarger is that if the negative is moved in the enlarger head, the image of the negative at the easel also moves. It moves at a speed which is governed by the magnification of the enlarger times the rate of motion of the negative. If one now moves the paper at the rate the image moves then at the paper surface the image of the negative will appear to remain stationary since the image and the paper are moving at the same rate.

An enlarger of this type was designed, patented and made by Itek Corporation in the late 50's. It made enlargements of aerial film exposed in "Sonne"-type aerial strip cameras and also aerial rotating prism panoramic cameras by moving the film past an exposing "slot" and at the same time moving the paper in synchronization with the moving image of the negative. The enlarger was essentially made to be "foolproof" allowing only two degrees of magnification and the problem of image/paper motion synchronization was overcome by making the movement of the two rigidly coupled to each other for the two degrees of magnification allowed.

I believe this enlarger was used to make a print of an unusual aerial "strip" negative that in the late '50s was exposed continuoulsy as an Air Force reconnaisance plane flew non-stop from the east coast to the west.

In the late 60's and early 70's I started independently working on developing an enlarger based on the principles described above. At the time I did not know about the Itek enlarger and so without bias from the Itek design, I proceeded to make an enlarger that would accommodate a wide range of magnifications.


Essentially I took a roller transport mechanism out of an old Polaroid One-Step or something like it - one roller steel, the other rubber covered - and attached a gear head DC motor to one of the shafts. Both were mounted on a "platform" which I attached to the side of the negative stage of the enlarger. The film thus could be drawn through the negative stage and into the roller transport mechanism and could then be moved smoothly and at a variable rate through the enlager head.

Just below the film I installed a mask made out of Wratten #25 filter material leaving a narrow slit ... maybe 2 or 3 mm in size running perpendicular to the film travel direction.

I then also modified a 16inch Kodak Ektamatic Paper Processor by attaching another DC gearhead motor to the shaft that normally would turn the drive mechanism at a high rate of speed. Since my motor turned at variable speed I was able to then have the capability of moving the paper relatively slowly through the empty processor and at a wide range of speeds.

When making an enlargement one adjusts the speed of the paper by watching either details in the moving image projected by the enlarger onto the paper or the grain pattern itself and noting the relationship between the rate of speed of these items vs. black dots that periodically placed onto the moving paper with a felt tip pen. If the dots move faster than the grain pattern one simply slows the paper speed down by lowering the voltage to the motor. If the dots lagged behind the voltage to the motor is increased.

Perfect registration between the reference marks placed on the paper and the grain pattern of the negative never remains perfect but it is generally small enough that the images on my enlargements are not noticeably blurred by slippage between the two.

The exposure time that any given spot on the paper receives can be determined by first determining the time that it takes a particular feature on the film film to pass by the "exposure slit" or by timing how long it takes a particular length of film to move past a given point on the enlarger head and dividing this into the size of the slit.

An alternative is to time how long it takes a dot or reference mark placed on the paper (after it has been adjusted to match the movement rate of the image) to pass across the image of the enlarged exposure slit.

Once this exposure time is known one can make some test exposures with the film actually standing still using the given exposure time and adjusting the aperture to generate a "test strip". Once the best aperture to achieve a given tone reproduction is decided, that is the aperture that is used to make the enlargement as well.

It helps, to improve sharpness due to slight mismatches in image/paper speeds to make the effective exposure time as short as possible. The consequence of this is that then the lens aperture needs to be as large as possible or more light needs to be generated by the enlarger lamp which means increased levels of heat need to be dissipated.

Finally, something to consider is that maginification ultimatley also plays a major role in determining how long it will take to make a given print. It becomes obvious early on that if one is making an 10x enlargement from a 35mm negative (roughly what an 11x14 print is made full frame from a 35mm negative) the rate at which the paper moves and the final length of the enlragement dictate the total exposure time.

In practice, even if exposure times are short, maybe 5 seconds, if the exposing slit at the paper is not too large (maybe 1 inch) the paper is only moving at 1/10" per second. If we are starting out with a 5 foot long 35mm negative, then at 10x maginification the final print will be 50 feet long. This is 600 inches and thus the total time required to make the print will be 600 inches divided by 1/10"/second or 6000 seconds which is almost two hours!

I have made 5x - 10x enlargements that range up to about 75 feet in length. If dodging and burning in of certain subject features is necessary that is not as easily accomplished with a strip enlarger but under certain conditions can be done by judiciously changing the exposing slit width.

Sometime in the late '70 or early '80s I attended the second IAPP Conference and there I met Phil Foss who had also been experimenting with making a "strip" enlarger as well as other panoramic photography "derivations". I will let him tell his own story of how his enlarger worked!

Today there is at least one commercially available strip enlarger and at least one lab that provides commercial enlargement services using it. The enlarger relies on stepper motors and a small "computer" to track the steps of the film and paper transport systems this achieveing a greater degree of control and precision than is possible with variable voltage

drives. The manufacturer is Seitz Phototechnik AG of Switzerland who also makes a panoramic camera known as the Roundshot.

If you would like to discuss this project with me I would be happy to provide whatever assistance is needed. Contact me at RIT, PO box 9887, Rochester, NY 14623. Phone 716-475-2592, fax 716-475-5804 ... but the fastest way is to just send me e-mail at andpph@rit.edu